

REMARKS

Claims 70-79 stand rejected on the ground of nonstatutory obviousness-type double patenting over claims 36-79 of U.S. Patent No. 6,310,366 ("Rhodes et al."). Applicants respectfully traverse this rejection and point out that Rhodes et al. does not have 79 claims; it has only 45 claims. Therefore, this rejection is ambiguous and unclear. Claims 120-130 stand rejected on the ground of nonstatutory obviousness-type double patenting over claims 20-35 of Rhodes et al. in view of U.S. Patent 5,471,515 ("Fossum"). Applicants respectfully traverse this rejection also because the claims of the present application are not obvious in view of the '366 and/or '515 patents. The rejections should be withdrawn.

Claims 70, 120, and 122-124 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 5,859,450 ("Clark") in view of U.S. Patent 4,578,128 ("Mundt"). Applicants respectfully traverse this rejection.

Claim 70 defines an imager and recites "an array of pixel sensor cells formed in a retrograde well on a substrate, the retrograde well being doped with a vertically graded dopant profile, wherein each pixel sensor cell has a photosensitive region and a photosensor formed at the photosensitive region; a circuit formed in the substrate and electrically connected to the array for receiving and processing signals representing an image output by the array and for providing output data representing the image; and a processor for receiving and processing data representing the image." Such a device would not have been obvious over Clark and Mundt.

"The mere fact that references can be combined or modified does not render the resultant combination obvious unless . . . the results would have been predictable to one of ordinary skill in the art." M.P.E.P. § 2143.01 (emphasis in original). If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *Id.* (citing *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)). "A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention." M.P.E.P. §2141.02 (citing *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303

(Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984). “‘When the prior art teaches away from combining certain known elements, discovery of successful means of combining them is more likely to be nonobvious.’” M.P.E.P. § 2143 (quoting *KSR Int’l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1740, 82 USPQ2d 1385, 1395 (2007)) (emphasis added).

Although Clark discloses a photosensor and Mundt discloses a retrograde well, these references are not properly combined in rejecting the claims under 35 U.S.C. § 103(a) because there would be no motivation to do so. The present application identifies the primary advantages of including the recited “retrograde well being doped with a vertically graded dopant profile” in photosensor cells as the repelling of signal carriers from the photosensor so they are not lost to the substrate and reducing noise by preventing carriers from the substrate from diffusing up into the photosensor. Clark identifies essentially the same needs as being met by its disclosed invention – minimizing dark current, reducing current leakage, and reducing noise (col. 1, ll. 27-43) –these identified needs are met by providing a guard ring (220) at the substrate (204) surface at an STI region (202) (col. 3, l. 30 to col. 4, l. 20). The guard ring (220) of Clark is a surface feature of its photosensor that is a heavily N-type doped substrate region that surrounds the photosensor.

Clark also discloses a dopant well (206) below the photosensor that interacts with the guard ring (220). Clark specifically indicates that its *invention*, i.e., the guard ring (220), satisfies its indicated *purpose*, i.e., it “contributes to a decrease of the dark current in the embodiment of the photodiode according to the present invention,” because the well is graded so that it has a higher p-doping near the substrate’s surface (col. 4, ll. 13-20). Thus, it is absolutely essential to the invention of Clark that its disclosed well be graded to have a higher dopant concentration at the substrate surface.

Mundt, on the other hand, discloses semiconductor devices having “retrograde” dopant profiles such that the dopant concentration must be lower toward the substrate surface and higher in a direction away from the substrate surface (col. 1, ll. 7-15). Even the portion of Mundt specifically cited by the Office Action (page 5) is clear on this: “In accordance with the present invention, an indiffusion-outdiffusion process is used to form the n-well 52N and p-well 52P and to form a

retrograde vertical dopant profile for such wells, in which profile the doping level at depth within the substrate, indicated by line 63 (FIG. 7), exceeds the doping level at the substrate surface” (col. 5, ll. 27-33). It is clear that the doping profile of Mundt’s well is incompatible with the structure of Clark as it is exactly the opposite from what Clark specifically *requires* in a doping profile. Incorporation of the Mundt well into the Clark device would make the device of Clark unsatisfactory for its intended purpose. Therefore, Clark and Mundt each specifically teach away from their combination.

Furthermore, even if the references did not teach away from their combination, which they do, or the Clark invention would function for its intended purpose with the Mundt well, which it would not according to the disclosure of Clark, there still would be no motivation to combine the retrograde well of Mundt with the photosensor device of Clark. As identified above, the present application explains that the primary advantages to including the recited “retrograde well being doped with a vertically graded dopant profile” (the feature identified in the Office Action as missing in Clark and supplied by Mundt) with sensor cells as preventing loss of signal and intrusion of unwanted signals in the photosensor. These advantages are indicated by Clark as being provided by its guard ring (220). Therefore, there is no reason, suggestion, or motivation to add yet another feature to the Clark device such as a retrograde well as recited in claim 70 as such would be superfluous, would further complicate the ultimate device, and would further complicate fabrication of the device – all of which are disadvantages.

For the above reasons, independent claim 70 is patentable over Clark and Mundt. Likewise, each dependent claim, 71-79, is also patentable over these references. Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of claim 70 be withdrawn and the claim allowed.

Claim 120 defines a CMOS imager and recites “an array of pixel sensor cells formed in a retrograde well in a substrate, the retrograde well being doped with a vertically graded dopant concentration, wherein each of said pixel sensor cells is separated by an isolation region that electrically isolates said pixel cells from each other, and each said pixel sensor cell comprises: a

photoconversion device; a reset transistor; a source follower transistor; a row select transistor; and a floating diffusion region in electrical communication with said photoconversion device and said source follower transistor.” Such a device not would not have been obvious over Clark and Mundt.

Similar to independent claim 70, independent claim 120 recites a “retrograde well being doped with a vertically graded dopant concentration.” As with the rejection of claim 70, the Office Action (page 5) relies on the teachings of Mundt to be combined with Clark to provide such a feature. However, as discussed above, Clark and Mundt are not properly combinable for this (or any other) purpose. The references are incompatible and teach away from their combination and combining the references would prevent the device of Clark from performing its intended purpose.

For the above reasons, independent claim 120 is patentable over the Clark and Mundt combination. Likewise, each dependent claim, 121-130, is also patentable over these references. Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of claims 120 and 122-124 be withdrawn and the claims allowed.

Claims 71-79 and 125-130 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Clark in view of Mundt and further in view of U.S. Patent 6,093,951 (“Burr”). Applicants respectfully traverse this rejection.

Claims 71-79 depend from independent claim 70 and claims 125-130 depend from independent claim 120, each of which is patentable over the Clark and Mundt combination, as discussed above. Burr is cited in the Office Action (pages 7-10) for its alleged disclosure of an array of pixel sensor cells and a processor being formed on a single substrate. Even if Burr contained such a disclosure, the combination of Burr and either of Clark or Mundt (which cannot be combined, themselves) would not satisfy each and every limitation of independent claims 70 and 120.

For the above reasons, claims 71-79 and 125-130 are patentable over the Clark, Mundt, and Burr combination. Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of these claims be withdrawn and the claims allowed.

Claim 121 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Clark in view of Mundt and further in view of U.S. Patent 6,657,665 ("Guidash"). Applicants respectfully traverse this rejection.


Claim 121 depends from independent claim 120, which is patentable over the Clark and Mundt combination, as discussed above. Guidash is cited in the Office Action (page 11) for its alleged disclosure of a transfer transistor positioned to gate charges between a photoconversion device and a floating diffusion region. Even if Guidash contained such a disclosure, the combination of Guidash and either of Clark or Mundt (again, not combinable themselves) would not satisfy each and every limitation of independent claim 120.

For the above reasons, claim 121 is patentable over Clark, Mundt, and Guidash. Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of this claim be withdrawn and the claim allowed.

In view of the above, Applicants believe the pending application is in condition for allowance. A notice of allowance is respectfully solicited.

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